



Astromaterials Research and Exploration Science Directorate

Newsletter – May 2011

The ARES Newsletter is a snapshot of current events within the Directorate, highlighting a small sample of the remarkable breadth and variety of the research activity and facilities in ARES and the people who do the work. Send Newsletter inputs and feedback to Greg Byrne.

In the News

Discovery of Another New Cosmic Mineral

For the second time in the past three years, a research team led by ARES scientist **Keiko Nakamura-Messenger** has discovered a new mineral within an extraterrestrial sample. The latest discovery is a titanium-sulfur compound with a crystal structure never before observed in nature; a tiny grain of material extracted from a 4.5 billion-year-old meteorite (Yamato691 enstatite chondrite, specifically) with characteristics unique enough to pass the strict criteria for “new mineral” status by the International Mineralogical Association (IMA).

Back in 2008, Keiko and her team were credited with the discovery of another new mineral, found within an interplanetary dust particle collected from the Earth’s stratosphere by NASA’s ER-2 aircraft; a story fascinating in itself that may have an encore (see the next article in this newsletter). That mineral was given the name *Brownleeite*. The latest find was announced in April 2011, and the name for this newest mineral, *Wassonite*, honors UCLA meteorite researcher John T. Wasson. Joining Keiko as co-discoverers of Wassonite are ARES researchers **Simon Clemett**, **Lindsay Keller**, and **Zia Rahman**, as well as other collaborators from outside of JSC. The significance of discoveries like this one was aptly summarized by Lindsay – “*Meteorites, and the minerals within them, are windows to the formation of our solar system.*”

The Wassonite and Brownleeite grains are some of the smallest minerals (450nm and 600nm, respectively) ever approved by the IMA as new minerals. To first recognize the grains as potentially new minerals, isolate them for analysis, and then fully characterize them to meet IMA standards are extraordinary accomplishments in astromaterials research made possible with the world-class nano-scale analysis instruments and expertise within ARES. For more on the story with images, see the NASA press release:

“More secrets of the universe can be revealed from these (extraterrestrial) specimens using 21st century nano-technology” – Keiko Nakamura Messenger

http://www.nasa.gov/home/hqnews/2011/apr/HQ_11-098_New_Mineral.html

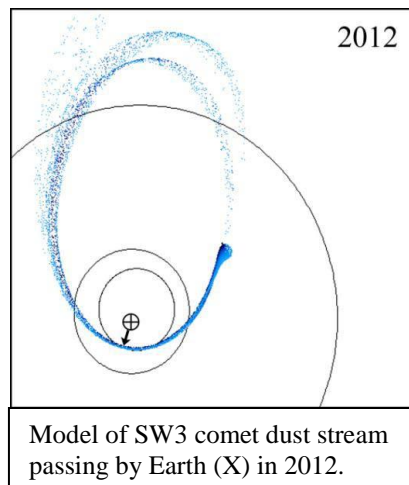
Sweeping Up Comet Dust

At this year's Lunar and Planetary Science Conference, **Scott Messenger** described to a captive audience an opportunity for collecting samples of a comet, no spacecraft required. Scott explained that a comet named Schwassmann-Wachmann 3 (SW3) is breaking up, and in the process is leaving high fluxes of dust in its wake. The Earth will pass through SW3's enhanced dust trail every year, with peak fluxes predicted in 2012, 2017 and 2023. The comet's orbit is also such that a fraction of the dust grains will intercept the Earth at relatively low velocities, thereby surviving entry into the atmosphere intact. The SW3 dust will join the tons of other interplanetary dust particles (IDPs) that enter the Earth's atmosphere every day from around the cosmos.

But among IDPs, the SW3s would be most valuable for research because not only are they from a known source, they are "fresh" – their short exposure to the space environment after being shed from the comet means that they are relatively unaltered from their parent state. If only there was an easy way to sweep up these dust particles from the atmosphere... There is, and Scott went on to explain that NASA has done it before with great success.

Almost a decade ago, Scott had made a similar prediction about dust from another comet, 26P/Grigg-Skjellerup (26P), and in response, in 2003 NASA flew the ER-2 high-altitude research aircraft into the stratosphere to sweep up some of the 26P dust. The ER-2 was outfitted with the Large Area Collector payload specifically designed for collecting IDPs (our own **Mike Zolensky** is the principal investigator for the ER-2 Cosmic Dust Program). After analysis, a portion of the collected IDPs were determined to have indeed originated from comet 26P, and upon further analysis, the new mineral *Brownleeite* was discovered by **Keiko Nakamura-Messenger** et al. within one of the 26P dust grains.

Stay tuned for an encore performance to sweep up comet SW3 dust as early as 2012.



The Wandering Life and Times of a Nebular Dust Grain

And the extraterrestrial sample research hits keep on coming... **Justin Simon** recently published a research paper in *Science* that generated much interest from the science media, entitled "Oxygen Isotope Variations at the Margin of a CAI Records Circulation within the Solar Nebula." This paper traces the formation history of a single grain of extraterrestrial material, a so-called calcium-aluminum-rich inclusion (CAI), imbedded within a meteorite almost 4.6 billion years old. Why study meteoritic CAIs? According to Justin, "*CAIs are some of the most interesting meteorite components. They recorded the history of the solar system before any of the planets formed, and were the first solids to condense out of the gaseous nebula surrounding our protoSun.*"

The grain's story begins with its core birth within the pre-Solar System nebula, and then its layered growth over time as it traveled through distinct regions of the protoplanetary disk, like a hailstone that builds up in layers as it circulates within a thunderstorm. Taking a cross-section of the grain, Justin used ion microprobe measurements to pinpoint the oxygen isotope



compositions within the grain's core and its overlying layers and compared the compositions to the abundances of oxygen isotopes that exist across the solar system. Justin conducted interviews about this research with media outlets from around the world to try to explain what the results mean in layman's terms. He gave it a good shot with the following: *"If you were this grain, you formed near the protoSun, then likely moved outward to a planet-forming environment, and then back toward the inner solar system or perhaps out of the plane of the disk. Of course, you ended up as part of a meteorite, presumably in the asteroid belt, before you broke up and hit the Earth."*

"Justin showed not only that this dust grain moved around the solar system over quite large distances, but that it had seen the gamut of possible places it could have been in the solar system," – Donald J. DePaolo, UC Berkeley & Lawrence Berkeley National Lab

The measurements for this research were performed while Justin was a post-doc at UC Berkeley, and he wrapped it up after he joined ARES in 2010. So, both NASA and UC Berkeley had news releases when the paper was published in *Science*. The Berkeley release is really good reading – [Oxygen isotope analysis tells of the wandering life of a dust grain 4.5 billion years ago - ScienceNewsline](#)

Congratulations are in Order

Space Flight Awareness Award

Dana Lear will represent ARES in the final group of Space Flight Awareness, Space Shuttle Launch Honorees. As such, Dana and guest will have the opportunity to attend the launch of STS-135, the final flight of Shuttle Atlantis, and the final mission for the entire Space Shuttle Program. Dana is recognized *"for valuable contributions made in improving NASA micrometeoroid and orbital debris (MMOD) risk assessment processes, software, and shielding used to prevent spacecraft failure from MMOD, and for applying these tools in improving MMOD protection of the ISS and commercial visiting vehicles."*

Let's keep our fingers crossed that the mission incurs no last-minute scrubs so Dana's trip to KSC is not wasted and he is able to witness this historic launch in person.

Silver Snoopy

The Silver Snoopy is the Astronaut Office's personal achievement award for those who enhance space flight safety and mission success. The latest ARES Snoopy honoree is **Kevin Beaulieu** of the Image Science and Analysis Group.

Kevin's Snoopy is much deserved *"for his outstanding work and dedication to enhancing crew safety through image analysis. He has consistently shown a strong commitment to providing the highest quality products and services and has delivered especially outstanding work in the areas of Shuttle Thermal Protection (TPS) inspection, Space Station blind spot analyses, and Orion TPS inspection evaluations."*



New Faces

Lee Graham joins the KX/Human Exploration Science Office on rotation from the Constellation Program Office. Lee brings a ton of NASA experience to ARES, having worked (here is where you may need the NASA acronym handbook) in SR&QA, MOD, SSF Program Office, ISS Program Office and the Cx Program Office. He sat on console for Safety for the first 10 launches after Challenger, most of the time giving Go/No Go's for launches (No Go just once!). He did a year's tour at HQ in what is now called SOMD, in their Chief Engineer's office, was the S&MA Manager on ISS, the Deputy Project Manager of the ISS Interim Control Module (based at NRL in Washington, D.C.), and the Manager of the JSC Systems Management Office doing independent reviews of programs and projects for JSC and HQ. He was also Acting Chief Engineer for JSC and was a member of the SEB for Orion. He also has a major interest in education and is on the industry advisory board of a non-profit Texas-based STEM education company called SystemsGo. Lee is completing a MS in Systems Engineering and starting a PhD program this fall. As a member of ARES, Lee will apply his wealth of experience to robotic precursor mission and instrument development.

Dave Melendrez also joins the KX/ Human Exploration Science Office on a rotational assignment from the Space Shuttle Program. Dave brings an outstanding portfolio of experience to ARES, with a MS in Planetary Geology & Remote Sensing from the University of Arizona and experience with deep space robotics (Mars Observer, Mars Global Surveyor) and human spaceflight (Shuttle, Station, Constellation). Most recently at JSC, Dave has worked as a flight controller in Mission Operations for 10.5 years and in the Shuttle Systems Engineering and Integration Office for 5.5 years. Now in ARES, Dave is back to his planetary science roots, and will apply his ops and systems engineering experience to space exploration mission development.